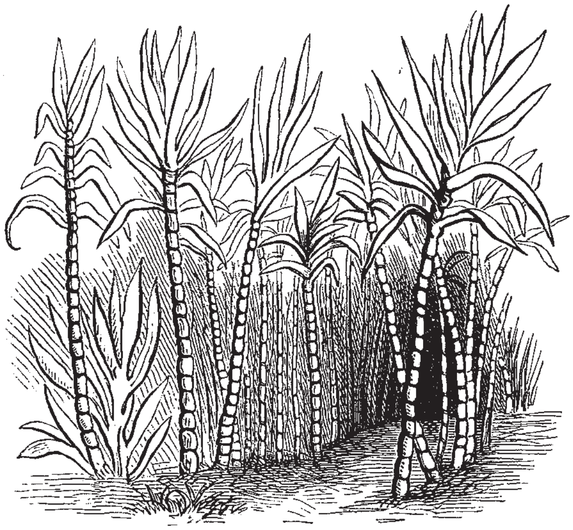
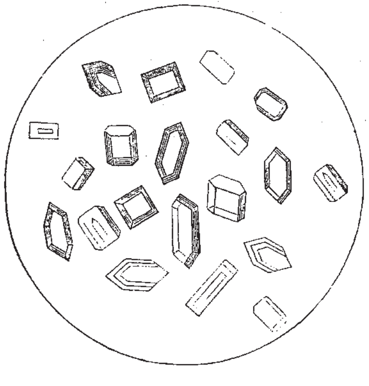
being kept a few weeks, during which time molasses continues to drain from it, it is packed in bags or hogsheads, and is ready for shipment. In this state it is known as raw, brown, or Muscovado sugar. The process of extracting and preparing the juice for export is not exactly similar in all countries; though the principle is the same, the practice varies according to the amount of intelligence brought to bear upon it.



FIELD OF SUGAR CANE

The drawing on the opposite page, which has been copied by permission of Mr. T. Baines from one of his paintings in the Kew Museum, represents the whole process of sugar making at a village in Eastern Tropical Africa. Under the tree, in the left-hand corner. is a native cutting the cane into lengths, and others collecting them into bundles which are afterwards passed between the rollers of the press, as seen in the centre of the picture. Boiling and crystallisation are shown in the right and left hand corners respectively.



SUGAR CRYSTALS MAGNIFIED

The quantity of saccharine matter contained in the cane varies according to the nature of the soil, climate, or other conditions under which the plants are grown. An acre of land under sugar cultivation may yield from one up to four tons of sugar, and from each ton of sugar after the first process of crystallisation somewhere about seventy gallons of molasses will drain; so that when we consider the labour required to keep a sugar plantation in full working order, such as tending the plants, expressing the juice, evaporation, crystallisation, and the subsequent waste both of sugar and molasses, as well in the draining on the voyage home, as during the time of its storage in the docks, and above all, the duty demanded upon sugar by the British Government, it does seem rather surprising that the article can be retailed at the price it is, though many are apt to call out that it is not so cheap as it ought to be. Sugar in its most common use cannot now be considered a luxury; to rich and poor alike it has become a necessity, indeed, amongst the lower classes a larger proportion is consumed than amongst the middle and upper section of the community, the average annual consumption per head of the whole population of the United Kingdom being about forty pounds. The East and West Indies, Mauritius, and Brazil now supply the bulk of the sugar brought into the English Market. It is imported in hogsheads and bags, the latter vary much in size and the sugar is also of various qualities, some of it indeed as it arrives has much the appearance of black muddy gravel or sand; most of this undergoes a further process of purification and recrystallisation in our own sugar refineries, which abound at the East end of London, as well as at Greenock, Glasgow, Liverpool, and Manchester. From these refineries the sugar comes out in the forms known in trade as lump or loaf sugar, crushed lump, pieces, and bastards.

The quantity of unrefined sugar entered for home consumption during the year 1869 was 11,188,081 cwts., and this exclusive of 1,025,929 cwts. of refined sugar and sugar candy, and 741,771 cwts. of molasses. The sugars best known in the British grocery trade are Demerara, Berbice, Barbadoes, Porto Rico, and Mauritius. These are sufficiently refined and crystallised in the colonies producing them as to suit the requirements of the retail trade. Those from Antigua, Cuba, Madras, Penang, &c., usually find their way into the hands of the refiners, brewers, and confectioners. Molasses is, as we have before said, the drainings from raw cane sugar. It is used for many purposes; large quantities of rum are distilled from it, often on the plantation where the sugar is produced; and where it is not so used it is exported, the sugar refiners in England buy it up largely, and produce a quantity of crystallised sugar from it. Rum, however, is usually made from the skimmings taken from the last boiling of sugar, which are mixed with proportionate quantities of molasses and water. Though molasses and treacle are often spoken of as identical, they appear to be different in their origin, for while the former is the drainings of raw sugar, the latter is the drainings of refined sugar. We have hitherto spoken only of cane sugar, or, to speak more correctly, of that obtained from the sugar-cane, but a large portion, indeed the bulk, of the sugar used on the Continent, is obtained from the beet-root (*Beta vulgaris*), the manufacture of which forms a separate article of industry.

JOHN R. JACKSON

NOTES

INTELLIGENCE has been received of an accident which occurred to H.M.S. *Psyche*, carrying the Sicilian section of the Eclipse Expedition from Naples to Catania; but, we are happy to announce, without injury to any of the passengers or crew, or loss of any of the instruments. The following are all the telegrams to hand at the moment of going to press:—"The *Psyche*, with the Eclipse Expedition on board, has struck on a sunken rock near Catania. All hands have been saved, and also the scientific instruments. The captain, who has behaved most nobly, is still on board, and, with a view to save the ship, has telegraphed to Malta for assistance." The following telegram has been received at the Admiralty:—"*Pysche* has struck, while running by chart, on a sunken rock near Catania. All saved. Instruments sent into Catania. Commander Fellowes has acted nobly, and hopes to save ship, if assistance comes at once from Malta, where he has telegraphed. *Royal Oak* sent for." We may congratulate ourselves that the expedition was in the hands of trained men belonging to one of Her Majesty's ships. We learn that nothing has occurred which need in the least imperil its success, and trust that even the ladies of the party will have suffered nothing worse than temporary inconvenience and alarm.

Mr. J. R. Hind, writing to the *Times*, states that, although the Eclipse of the Sun, which takes place to-day, will have been exceeded in magnitude by more than one of the eclipses which have been visible in this country during the last thirty years, it will yet be the greatest eclipse that can be witnessed in England during the remaining thirty years of the present century, and on this account possesses a degree of interest which does not always attach to partial eclipses. If we take successive intervals of thirty years, commencing with 1781, and note only those eclipses visible in London, in which the moon has covered more than half the sun's diameter, we find between 1781 and 1810 two eclipses, between 1811 and 1840 six eclipses, between 1841 and 1870 seven eclipses, while between 1871 and 1900 there will be one eclipse only of similar magnitude. This single eclipse in the ensuing interval of thirty years will not occur until the last year of the century, or till the 28th of May, 1900, and the magnitude will not then quite reach 0·7 of the sun's diameter. The next solar eclipse visible in England is a small one on the morning of May 26, 1873.

The French Eclipse Expedition may not have proved a failure, as has been feared. We have received intelligence from Paris that on the 1st December M. Janssen left in a balloon, assisted by a sailor. No letter was given him in order to prevent the Prussians detaining him as a prisoner of war. A balloon reached Brittany about that time, and was styled a private balloon. Telegrams and notices were sent to France from Mr. Lockyer, to invite M. Janssen to join the English Eclipse Expedition, but it appears that none of these communications have reached him, owing to the interruption of regular postal telegraphic service in France. M. Janssen was intending to proceed to Medeah, an Algerine town.

Some time ago we announced that Sir Roderick Murchison had offered the munificent sum of 6,000*l.* for the endowment of a Chair of Geology and Mineralogy in the University of Edinburgh, on the understanding that the annual proceeds of this sum would be supplemented by a grant from Parliament. We are happy to state that Government has consented to this proposal, and has agreed to recommend an annual grant of 200*l.* This desirable result (for which the University, we believe, is largely indebted to the earnest co operation of its member, Dr. Lyon Playfair) will be welcomed as another evidence that our authorities are not so indifferent as they have been supposed to be to the claims of scientific education.

Dr. Hureau de Villeneuve, secretary to the French Aëronautical Society, and editor to the *Aëronaut*, a paper devoted specially to aëronautics, has established at his residence an ambulance for aëronauts. He had to attend to a few cases from accidents of different descriptions in the management of captive balloons, and fewer of soldiers who had drawn the ropes for their aërial observations. M. de Villeneuve is to open a regular course of lectures on aëronautics at the Petite Sorbonne. It is the third time that a regular course of lectures has been delivered in Paris on this subject: the first time by Dupuis Delcourt, at the Athénée about forty-five years ago, when Comte was delivering his lectures on Positive Philosophy; the second time by M. W. de Fonvielle, at the Lecture Hall of the Boulevard de Capucines, three years ago.

The new Meteorological Observatory established by the city of Paris in the well-known Palais du Bey de Tunis, which was a part of the great Champ de Mars Exhibition, is no longer in operation. It was put into requisition to be used as a barracks. M. Sainte-Clair Deville, the elder, who was the director, has protested against such a requisition, but his protest was wholly disregarded.

M. Marie Davy is now in Paris, and engaged in meteorological observations, as well as M. Chapelas Coulvier Gravier, who keeps his watch from the Luxemburg Palace for falling stars. He publishes regularly the records of the observations in the *Comptes Rendus* and the *Journal Officiel*. He has published a description of several magnificent auroral displays, which were described by several witnesses in different papers.

A very influentially-signed memorial from heads of houses, professors, tutors, lecturers, and fellows of colleges in the University of Cambridge, has just been sent to the Lord President of the Committee of Privy Council on Education. The memorial prays that women may be appointed to the office of Inspector of Schools, and points out some of their qualifications for that responsible office. The memorial is signed by seventy-two resident graduates, all of whom are fellows of colleges or hold college or university offices in the University of Cambridge. Among those who sign are the Vice-chancellor and five other heads of houses, including the Masters of Trinity and St. John's; nine university professors; the senior tutors of every college, with three exceptions; all the tutors, assistant tutors, and lecturers of Trinity College, with two exceptions; and of the remainder all except eight are engaged officially in teaching in the Colleges or University.

The death is announced, in his seventy-first year, of the Rev. Joseph Bancroft Reade, President of the Royal Microscopical Society. He was educated at Caius College, Cambridge, where he took his B.A. degree in 1825, when he was thirty-sixth senior optime in the mathematical tripos. In 1839 he was presented by the Royal Astronomical Society to the vicarage of Stone, near Aylesbury, and at the time of his death was rector of Bishopsbourne, near Canterbury.

We shall be much obliged to any of our correspondents who will oblige us (for the purpose of drawing up a tabular account) with particulars of any hitherto unrecorded meteorological phenomena which may have occurred during the present year, as auroras, earthquakes, large sun-spots, meteors, storms, volcanic eruptions, haloes, &c. Similar information will be very acceptable from the continent of Europe, America, or the Southern Hemisphere.

The Royal Horticultural Society has been compelled, by the pressure on its funds, to dispose of a portion of its gardens at Chiswick, the most valuable portion of its property in a scientific point of view. Among the articles sold were a number of fine trees, Pyramid Pears, Dwarf and Trained Apples, Filberts, Wellingtonias, Cupressus, Piceas, Araucarias, &c., in all no less than 12,757 plants, fetching about 600*l.* The portion of the Gardens which still remains covers about 33 acres; and the orchard will be reorganised on a smaller scale, and the trials and experiments, practical and scientific, will still be carried on. The Gardens were originally founded in 1821.

The galleries of the Royal Albert Hall, which are to be used for the display of architectural drawings and models in the forthcoming International Exhibition of 1871, are approaching completion. Architects have been invited to inspect the Hall, and to see the galleries appropriated to their works, on Wednesday, December 21, at 11.30 A.M. Some trials of the acoustic properties of the building were to be made between 12 and 12.30.

The *Journal of the Society of Arts* states that the Council of the Society has sanctioned a plan for establishing a National Training School of Music. For promoting this purpose it is proposed that a musical section of the society be instituted, with a separate fund, in order to give concerts annually in the Royal Albert Hall; these concerts to consist of vocal and instrumental music of the highest character. After paying the expenses of the concerts, the profits are to be applied to the establishment of a National Training School for Music.

THE Perthshire Society of Natural Science proposes starting a Quarterly Magazine, to be called the *Scottish Naturalist, and Journal of the Perthshire Society of Natural History*. It will be specially devoted to recording observations and discoveries made in the northern part of this island; and it is intended that it shall contain (in addition to the "Proceedings" of the Society), reports of the meetings of Scottish Natural History Societies; a record of Scottish captures; observations and discoveries both zoological and botanical; scientific jottings; notes and queries; lists of species for distribution in exchange, &c. As the carrying out of this scheme depends entirely upon the encouragement and support received by the Society, it is hoped that those interested will at once send in their names as subscribers to the honorary secretary, Mr. A. T. Scott, Clydesdale Bank, Perth.

THE *Saturday Review* of December 10 refers to "the gigantic Lycoperdon, or Puff-ball, which in one night acquires the bulk *of a child of ten years old*, and produces about 96,000,000 cells a minute!" We have both seen and heard of Puff-balls as large as a child's *head*, but one of this "bulk" is, we imagine, somewhat rare.

THE Folkestone Natural History Society has issued the following programme of its proceedings for the present (its third) winter session:—Nov. 8: Public lecture on "Solar Eclipses," Rev. C. L. Acland, M.A. Nov. 23: Microscopical Conversazione. Dec. 13: Public lecture on "Food, and the Process of Digestion," F. Fagge, Esq., F.L.S. Jan. 10: Public lecture on "Fossils and their Teachings," Henry Ullyett, hon. sec. Feb. 1: Annual meeting. Feb. 7: Public lecture on "The Natural History of Language," by W. J. Jeaffreson, Esq., M.A. Feb. 22: Ordinary meeting, paper, and discussion. March 7: Public lecture on "Iceland and Spitzbergen," by C. E. Fitzgerald, Esq., M.D., president. March 22: Ordinary meeting, paper on antiquities, and discussion. March 28: Public lecture on "The Materials for Antiquarian Research in S. E. Kent," by the Rev. Canon Jenkins. A class in Botany is held every Wednesday, at 4 P.M., by the Rev. C. L. Acland, and one in Geology every Monday at 8 P.M., by Mr. Ullyett. The Museum is open free on Thursday evenings and Saturday afternoons, as well as on the occasion of meetings; and a library of reference is in course of formation.

MR. EDWIN C. REED has been employed by the Director of the Museum of Santiago, in Chili, to arrange the insects. He has classified the foreign insects, which had hitherto remained unpacked. Mr. Reed is preparing a Chilian collection to send to California in exchange for a collection from that country.

THE United States Government commenced on the 1st of November the publication of a daily record of the state of the weather in various parts of the country. The following extract from the *New York Journal of Commerce*, dated Nov. 5th, shows the view entertained in the States on this subject:—"The Federal Government has lately done one thing which men of all parties will agree in commending heartily. It has made arrangements to furnish daily reports of the markings of the barometer and thermometer, the direction, velocity, pressure, and force of the wind, and the state of the weather, at points in different parts of the country. The shipowner, master, or merchant, reading this journal, has before him every day trustworthy advices of the weather all over the United States only a few hours old, and sufficiently fresh to apprise him of the danger or safety of sailing or making shipments from this port. Much depends on the accuracy of the reports, and for that we find good assurance in the fact that they are prepared by army officers, most of whom have received an education scientific and practical enough to qualify them for the work. The Associated Press have made an appropriation to have an observer among the party who will watch through the winter on the top of Mount Washington, White Mountains. From that point also we expect to receive daily bulletins, which will not only be serviceable to commerce, but in our coldest weather here may make people more comfortable to think how much colder it is away up on that windy peak. Prof. Hitchcock will be in charge of the party, which comprises a number of able scientists. The Chamber of Commerce is making a move to supplement the action of the Government at this point with a little more money." The places at present contributing "weather reports" are Augusta (Ga.), Boston, Buffalo, Cleveland, Cincinnati, Chicago, Cheyenne, Detroit, Duluth, Lake City (Fl.), Milwaukie, Montgomery, Mobile, Nashville, New Orleans, New York, Oswego, Omaha, Rochester, St. Paul, St. Louis, Toledo, and Washington.

A ST. PATRICK, says the *Pall Mall Gazette*, is evidently wanted in India as much as ever he was in Ireland. During the year 1869 no fewer than 11,416 persons in the Bengal Presidency died from the effects of snake bite. The return giving us this information has been carefully compiled; all the merely sick and wounded have been omitted, as well as those sudden deaths which in India are often attributed to snake-bites by heirs to property unduly eager for their inheritance. Such a mortality from such a cause is sufficiently startling to the sophisticated mind of a stay-at-home Englishman, but the more surprising fact remains that this destruction of human life goes on year by year, and that no efficacious means are adopted to check its ravages.

The *Pall Mall Gazette* states that we owe our supplies of Indian cotton to the American war, and we may have to refer the cultivation of tobacco in our colonies to the present campaign. A good deal of the leaf employed in the manufacture of cut tobacco comes to us from the Continent, and of course that source is now closed; but the smoker may be consoled by hearing that India, Jamaica, and Natal are all engaged in cultivating the plant. Latakia from the West Indies has been received in London and reported upon favourably, and the samples of tobacco from Natal are said to be remarkably good. What the Indian Government has already done for the cultivation of tea, cinchona, and ipecacuanha, it is now doing for the tobacco plant. Seeds of the best varieties have been distributed in suitable districts, and the time may speedily come when the Bengal cheroot may be a production of the Presidency.

FROM the report of the cotton department of India it seems that the crops in the several districts have, during the past year, yielded a satisfactory return. We also learn that a very extensive system of adulteration exists by mixing two or more qualities in one bale, to which a stamp, indicating a superior quality, is affixed. With regard to the use of English ploughs which have been introduced, it is said that "the cohesion and tenacity of the richer black cotton soils are evidenced by the manner in which they get rent and cracked into deep fissures instead of becoming pulverised by the rapid contraction they undergo when exposed to the fierce rays of the sun after the crops have been removed, and from the same cause the upper surface becomes baked and hardened into a crust, which is about as inaccessible to the plough as if it were a pavement. The cultivator has accordingly to wait until the advent of the monsoon has softened and removed this crusty impediment, and, if it should happen that the first crusts are very heavy and continuous, he is still further delayed from an opposite cause, namely, on account of his fields having become too soft for his cattle to move on, so that he has to wait for a favourable break to get rid of the surface moisture." In this state of the land the plough gets clogged, and the animals have not strength to move the instrument, so that "both ploughs and ploughmen succumb, and the antediluvian implement of the ryot is found to be the only feasible one."

SOME idea of the damage done to vegetation by locusts in tropical countries may be gathered from the following account of a raid made by them in an East Indian cotton plantation. The means adopted to repel them was by recourse to the discordant sounds of native music—horns, tom-toms, and pipes—aided by the waving of flags and branches of trees. These measures, undoubtedly, saved the produce; for, judging by the performance of the very small number that succeeded in gaining admission to one of the finest fields unobserved, had a full complement effected a lodgment, one hour would have sufficed to strip every tree of its leaves, though the foliage was abundant, and the plants in one field from five to six feet high. The immunity which the native Indian cotton enjoyed from the attacks was considerable, considering the avidity with which they devoured the exotic descriptions, and, true to their early traditions, the Egyptian was evidently an especial favourite. Some of the swarms that passed over the country at that time were exceedingly numerous. The arrival and settlement of one mighty mass was a remarkable sight. What was first observed was a sort of haze on the verge of the horizon, in a long line, as if a steamer had passed, and its smoke was rising into vapour; this was some hours before the insects arrived. The cloud gradually thickened, and rose higher as they approached. When they got fairly overhead the air became darkened as if night was setting in, it being yet mid-day, and the peculiar sound which accompanied their flight resembled that of the rustling of the leaves of the peepul tree when agitated by light winds; but it is not until they have settled down that any idea can be formed of the immensity of their numbers, and the early dawn, before sunrise has warmed them into life and motion, is the time to witness this most extraordinary sight. In the instance now referred to the appearance the face of the country wore would be best described by supposing that a tolerably heavy fall of snow had taken place, only that the colour of it was a light brown, and this extended for miles, as far, indeed, as the eye could reach. Trees were favourite perching-ground for the night, and the manner in which they contrived to crowd upon them, piles over piles, concealing every vestige of leaf and branch, gave the trees a singular appearance. At one spot a stout and wide-spreading branch of a banyan tree had snapped at its stem from the incumbent weight of the insects.

RICH mines of gold and silver are being daily discovered in the State of Tulima, in Columbia, according to late advices.

A RECENT number of the American *Journal of Chemistry* contained the following story of the first introduction of the stereoscope to the *savants* of France. The Abbé Moigno took the instrument to Arago, and tried to interest him in it; but Arago unluckily had a defect of vision which made him see double, so that on looking into the stereoscope he saw only a medley of four pictures. The Abbé then went to Savart, but he was quite as incapable of appreciating the thing, for he had but one eye. Becquerel was next visited, but he was nearly blind, and consequently cared little for the new optical toy. The Abbé, not discouraged, called next upon Puillet, of the Conservatoire des Arts et Métiers. He was a good deal interested in the description of the apparatus, but unfortunately he squinted, and therefore could see nothing in it but a blurred mixture of images. Lastly, Biot was tried, but Biot was an earnest advocate of the corpuscular theory of light, and until he could be assured that the new contrivance did not contradict that theory, he *would* not see anything in it. Under the circumstances, the wonder is that the stereoscope ever got fairly into France.

MIMICRY AND HYBRIDISATION *

SOME time since I had occasion to study with care, for the purposes of a work on which I am engaged, the phenomena of mimetic analogy made known by Mr. Bates, which have lately formed the subject of discussion at the British Association, and in the pages of NATURE, in which I observe with pleasure that one of our body, Mr. A. W. Bennett, has borne an honourable part. Neither he nor any of the gentlemen who have written on the subject, have, however, so far as has come under my notice, brought the point to its real issue. They have accepted battle on the field on which Mr. Bates has placed it, and although they may have achieved a victory over him, they have not succeeded in rescuing the subject from its obscurity. He may be wrong without their being right. I am not surprised at their having been led to accept his premises; when I first approached the subject I did the same; but the longer I live and the more extended my experience becomes, the more surely do I find that when a theory looks shaky and unsound, the place to look for the flaw is not in the upper story, but in the basement. It is in the foundation that the crack will almost invariably be found. I am sure it is so here.

Mr. Bates found in the Valley of the Amazons a number of species of a Northern tribe of butterflies, wearing the colour and form of a Brazilian tribe, and so like in their varieties and strains that they obviously represent some different phenomenon from the ordinary one of mere difference in species. To account for this he devises a theory on the Natural Selection plan. The Brazilian tribe has a bad smell, and birds and insects of prey consequently do not feed upon them, and the Northern tribe, in the course of their variation in the dark, accidentally produce one something like the Brazilian one, which produces others in the same direction by Natural Selection, until the mimics are brought to perfection. Every inch of the ground he goes over here is mined and unsound—the bad smell has not been observed in North America where similar mimicry occurs—birds and insects of prey hunt by sight and not by smell, and the various communications on the subject in NATURE point out a variety of other insuperable objections. But my object is not so much to show that a friend and entomological brother has been seduced by a "bad smell" to go on a wrong scent, like a good dog after a red herring, but to find out the true explanation of the phenomenon.

The explanation seems to me to be simply Hybridisation; but before committing myself to it, as there were one or two points on which I was not sure how far the phenomena corresponded with those of hybridisation in plants, I applied to my friend Mr. Isaac Anderson Henry for information upon them, and he has sent me a paper (for the Scientific Committee of the Horticultural Society), as well as some other information, which enables me now to say that there is not a phase or a fact in the mimicry in question, for which I cannot produce the exact counterpart in the hybridisation of plants.

In the first place the mimicked and the mimickers are always found together, and even the mimickers of varieties are only found beside the varieties that they mimic. Now, it is plain that if the resemblances be due to hybridisation, it is inevitable that the two must always be found together, at least in the first instance. It may be that after the hybrids are established and advanced into the position of actual species, the species (*i.e.* the parent and offspring) might diverge from their primary locality, the one to the right and the other to the left, and so cease to be found together; but this must be an after act, and consequently an exception. The natural condition is to find both together, and so they are always found together. But this would not be the natural condition if the mimicry were produced by Natural Selection. The same enemies are found over thousand of miles, and the same kind of enemies over tens of thousands; and there is no advantage to be gained by mimicking one variety of Danais more than another. The same advantageous results would be obtained by mimicking in the east the form that prevails in the west, or in the north the form that prevails in the south, but the imitation of each variety is limited to the district which it inhabits, however narrow and restricted it may be. Natural Selection, therefore, fails entirely to account for the localisation of the mimickers of varieties.

In the next place the mimicked occur always in overwhelmingly greater numbers than the mimickers. Mr. Bates says:—"The Ithomiæ (Danaids) are all excessively numerous in

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* This paper was originally presented to the Scientific Committee of the Horticultural Society (Dec. 7, 1870), but has not yet been published elsewhere.